UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

HUNTER HARRIS and CORA CLUETT Plaintiffs, v. UNIVERSITY OF MASSACHUSETTS LOWELL, JACQUELINE MOLONEY, UNIVERSITY OF MASSACHUSETTS BOSTON, MARCELO SUAREZ-OROZCO and SHAWN DE VEAU, Defendants.	C.A. No. 1:21-cv-11244-DJC

DECLARATION OF SHARONE GREEN, M.D.

I, Sharone Green, M.D. do declare, under penalty of perjury and pursuant to 28 U.S.C. § 1746, as follows:

1. I am over 18 years of age. This declaration is based upon my own personal and professional knowledge and experience.

2. I am competent to testify as a medical expert to the facts and matters set forth herein. A true and accurate copy of my C.V. is attached as Exhibit A.

3. I received my B.A. from Queens College of the City University of New York and my M.D. from Eastern Virginia Medical School in Norfolk, VA.

4. I completed an internal medicine residency at Washington Hospital Center, Washington D.C. I am Board Certified in Internal Medicine by the American Board of Internal Medicine.

5. I completed a fellowship in infectious diseases at the University of Massachusetts Medical Center. I am Board Certified in Infectious Diseases by the American Board of Internal Medicine.

6. I serve the University of Massachusetts Medical School ("UMMS") as an Associate Professor of Medicine in the Division of Infectious Diseases and Immunology.

7. I have over 30 years of experience in clinical and basic science research in emerging viral

diseases including dengue, West Nile virus, Japanese encephalitis virus, chikungunya virus, and Zika virus with a special interest in viral pathogenesis and protection from vaccines. I resided in Thailand for 4 ½ years to establish a clinical trial of dengue hemorrhagic fever in Thai children in Bangkok and Kamphaeng Phet, Thailand in collaboration with the Armed Forces Research Institute of Medical Sciences. My research has included participation in a Phase I clinical trial of a HIV DNA prime/protein boost vaccine candidate which enrolled study subjects at UMMS. Additionally, I studied human antibody and T cell responses to dengue virus using samples from Thai children and conducted clinical laboratory T cell studies using samples from adults enrolled in Phase I and II candidate West Nile and Japanese encephalitis virus vaccine clinical trials. I have been the Project Leader for several NIH-funded Program Project grants and NIH contracts. I have authored 90 papers in the fields of viral immunopathogenesis and vaccine research and have participated in several NIH Special Emphasis Panels on emerging viral diseases.

8. I am currently the Infectious Disease Officer at UMMS. UMMS established this position in May 2020 in response to the COVID-19 pandemic to provide a safe learning and research environment for medical students, nursing students, graduate students, faculty, and staff. When UMMS initially returned employees to the workplace on May 26, 2020, I was responsible for COVID-19 PCR screening of approximately 2,400 employees, a novel concept at that time. My responsibilities since that time have included development and oversight of COVID-19 Infection Control plans for UMMS employees and students, leading a multidisciplinary team for the establishment and oversight of a COVID-19 surveillance site at UMMS and several satellite testing sites, oversight of an Infection Control Team for notification and contact tracing of students and employees who test positive for COVID-19, communications and education related to COVID-19 in numerous leadership forums as well as monthly Virtual Town Hall meetings. In this role, I collaborate with the Infection Control team at UMass Memorial Medical Center, Employee Health Services and Student Health Services. I have participated in several outreach efforts as well, including: (a) supervision of a team of contact tracers for The College of the Holy Cross, Worcester, serving as consultant when needed; (b) serving as an expert reviewer for Commonwealth Medicine's investigation of the COVID-19 Outbreak at the Soldier's Home in Chelsea which was requested by Governor Baker; and (c) ad hoc consultant on COVID-19 to other universities in HECCMA.

9. As an Infectious Disease physician, I attend on the consultation services at UMass Memorial's University and Memorial campuses and participate in clinical case conferences. Since the start of the pandemic, I have consulted on numerous hospitalized COVID-19 patients, several of which were young adults. I have been an active participant in Infection Control activities at UMass Memorial Health campuses related to COVID-19 since the beginning of the pandemic.

COVID-19 Facts

10. COVID-19 is an infectious disease caused by (SARS-CoV-2), the novel coronavirus that primarily spreads through respiratory droplets and aerosol transmission.

11. People of all ages can contract and transmit COVID-19.

12. People who contract COVID-19 may suffer from immediate severe illness and/or suffer long-term ongoing health problems, extending several weeks or months. Individuals infected with COVID-19 can suffer these long-term negative health effects even if they were initially asymptomatic. COVID-19 can also be fatal. *See* https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects.html; https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2778237

13. Additionally, all individuals, including children and young people, who contract COVID-19 risk giving it to others, including friends, family, and other individuals with whom they interact; those individuals may suffer severe illness or death. While COVID-19 affects children and young adults less severely than middle aged or older adults, COVID-19 has also been shown to cause severe illness in children and young adults. *See* https://www.cdc.gov/coronavirus/2019-ncov/faq.html and https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission_k_12_schools.html

A Brief Background of the COVID-19 Pandemic.

14. COVID-19 was first identified in Wuhan, China in late 2019.

15. According to the Massachusetts Department of Public Health, the Commonwealth's first case of COVID-19 was confirmed on February 1, 2020. *See* https://www.mass.gov/news/man-returning-from-wuhan-china-is-first-case-of-2019-novel-coronavirus-confirmed-in. The Commonwealth's first COVID-19-related death was confirmed on March 20, 2020. *See* https://www.mass.gov/news/massachusetts-public-health-department-reports-states-first-death-from-covid-19

16. Since February 2020, Massachusetts has had over 686,018 confirmed COVID-19 cases (and 48,468 probable cases) and 17,773 people have been confirmed to have died from COVID-19 (with an additional 370 deaths denoted as probably due to COVID-19). *See* https://www.mass.gov/info-details/covid-19-response-reporting (last visited August 14, 2021).

17. Data recorded through August 15, 2021 by CDC demonstrates that cases among individuals aged 18 through 29 across the U.S. account for 23% of COVID-19 infections (6,595,936 infections) and 2,870 individuals in that demographic have died from the virus. *See* https://covid.cdc.gov/covid-data-tracker/#demographics.

18. Surveillance testing for COVID-19 on many college campuses may have led to more reported cases, but certainly does not account for the majority of cases. For example, in Massachusetts where a large proportion of colleges have implemented surveillance screening, a total of 18,371 individuals have thus far tested positive of 8,334,417 tests

submitted. *See* https://www.mass.gov/info-details/covid-19-response-reporting#covid-19-interactive-data-dashboard- (accessed 8/15/2021). These positive cases may represent non-student cases (e.g. faculty and staff working on campus) as well.

19. The CDC currently estimates that there have been approximately 35 million cases of COVID-19 in the United States and over 600,000 people have died from COVID-19 in the United States. *See* CDC, COVID Data Tracker, Nationwide Commercial Laboratory Seroprevalence Survey, *https://covid.cdc.gov/covid-data-tracker/#national-lab.*

20. The New York Times reports that over 700,000 cases of COVID-19 have been linked to colleges and universities in the U.S. since the pandemic began and more than 260,000 COVID-19 cases have been linked to colleges and universities just since January 1, 2021. *See Tracking Coronavirus Cases at U.S. Colleges and Universities*, The New York Times, *https://www.nytimes.com/interactive/2021/us/college-covid-tracker.html*.

21. A growing number of colleges and universities in the United States are requiring their students to be vaccinated against COVID-19 prior to the fall, 2021 semester. The current number is over 600. *See* https://www.bestcolleges.com/blog/list-of-colleges-that-require-covid-19-vaccine/.

Vaccination as a Public Health Strategy.

22. COVID-19 vaccination is considered by CDC to be the best strategy for protecting individuals from COVID and ending the pandemic. *See* https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/considerations.html; https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html

23. CDC recommends that vaccination of students and employees against COVID-19 on college and university campuses is the best strategy for individual and campus-wide protection. *See* https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/considerations.html

24. COVID-19 vaccination is widely available for free to anyone living, working, or learning in Massachusetts. *See* https://www.mass.gov/info-details/covid-19-vaccination-locations

25. There are three vaccines currently available in the United States under Emergency Use Authorization (EUA): the Pfizer BioNTech mRNA vaccine, the Moderna mRNA vaccine and the Johnson and Johnson/Janssen viral-vectored vaccines ("COVID-19 vaccines"). *See* https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/how-they-work.html

26. EUA is an approval mechanism used by the Food and Drug Administration to facilitate vital countermeasures, such as COVID-19 vaccine, during a Public Health

Emergency such as the COVID-19 pandemic. This approval mechanism for COVID-19 vaccines in no way jeopardizes the rigorous and science-based standards for quality, safety and effectiveness of COVID-19 vaccines. *See* https://www.fda.gov/vaccines-blood-biologics/vaccines/emergency-use-authorization-vaccines-explained); Science Brief: COVID-19 Vaccines and Vaccination, https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html.

27. All three COVID-19 vaccines available in the U.S. under EUA have undergone study in rigorous multi-center, international, randomized controlled Phase 1, 2 and 3 clinical trials. *See* Science Brief: COVID-19 Vaccines and Vaccination, https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html

28. All three COVID-19 vaccines demonstrated a high level of efficacy in Phase 3 clinical trials (Pfizer BioNTech 95%, Moderna 94.1%, Johnson and Johnson 72%) (Pfizer: https://www.nejm.org/doi/full/10.1056/nejmoa2034577; Moderna: https://www.nejm.org/doi/full/10.1056/nejmoa2035389; Johnson and Johnson: https://www.nejm.org/doi/full/10.1056/NEJMoa2101544); Comparison: Comparing the COVID-19 Vaccines: How Are They Different? > News > Yale Medicine). Overall, these are some of the most effective vaccines ever developed. In comparison, influenza vaccine efficacy is much lower (19 – 60% over the last 10 years) but is required at many universities in Massachusetts. *See* https://www.cdc.gov/flu/vaccines-work/effectiveness-studies.htm. Post-vaccination infection rates are low following COVID-19 vaccination. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7021e3.htm

29. Each of the COVID-19 vaccines available in the US has been shown to be safe and effective. Over 357 million doses of the COVID-19 vaccines have been administered in the United States between December 14, 2020 and August 15, 2021. *See* CDC, Safety of COVID-19 Vaccines, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/safety-of-vaccines.html; https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total

30. COVID-19 vaccines are highly effective in preventing hospitalizations and deaths due to COVID-19, including those variants that are currently circulating in Massachusetts. Individuals who are vaccinated against COVID-19 are less likely than unvaccinated individuals to be infected or to be able to transmit virus to others, including Delta variant. However, the risk of so-called breakthrough infections cannot be eliminated while there is continued high level community transmission. *See* Science Brief: COVID-19 Vaccines and Vaccination, https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html

31. Following COVID-19 vaccination, it takes time for the body to develop an immune response. Someone is considered 'fully vaccinated' 14 days after their second dose in a 2-dose vaccine series (e.g. Pfizer BioNTech or Moderna mRNA vaccine) or 14 days

after a single dose vaccine (e.g. Johnson & Johnson viral vector vaccine).

32. Re-infection with COVID-19 may occur in individuals following natural infection due to waning immunity. CDC therefore recommends COVID-19 vaccination in individuals who have previously had COVID-19. *See* Kentucky-MMWR *Reduced Risk of Reinfection with SARS-CoV-2 After COVID-19 Vaccination,* August 6, 2021, https://www.cdc.gov/mmwr/volumes/70/wr/mm7032e1.htm.

33. CDC recommends that children age 12 and older receive COVID-19 vaccine because children may become infected with SARS-CoV-2, become ill, and may spread the virus to others. Vaccinating older children and teens helps to protect other family members (younger siblings who are ineligible for vaccine, family members at high risk for COVID-19) and other individuals with whom they interact. *See* COVID-19 Vaccines for Teens and Children, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/adolescents.html.

Safety of COVID-19 Vaccines

34. COVID-19 vaccines are safe and are extremely unlikely to cause serious side-effects that could lead to long-term health consequences. *See* CDC, Safety of COVID-19 Vaccines: https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html.

35. In terms of safety, there is no evidence for genotoxicity, mutagenicity, teratogenicity, or oncogenicity for any of these COVID-19 vaccines.

36. The Pfizer, BioNtech, and Moderna mRNA vaccines use mRNA, which is a snippet of genetic information but it is not a gene. It does not enter the nucleus or become part of a person's DNA. The mRNA instructs cells to make the 'spike' protein of the virus that causes COVID-19. This protein is presented to a person's immune cells and causes production of SARS-CoV-2 spike-specific immune responses (antibody and T cells). The Johnson and Johnson vaccine is a more traditional vaccine, except that it uses a disabled adenovirus to deliver the 'spike' protein instructions to a person's immune system. The 'spike' is an entry receptor for the virus that causes COVID-19. This protein cannot cause tissue damage, lead to infection, or lead to complications. The immune response to this protein has been found to cause some rare adverse events such as myocarditis and blood clots (see discussion below), but the risks of these side effects is extremely low compared to the risks of severe complications from natural COVID-19 infection. *See* Torjesen, COVID-19: "Risk of cerebral blood clots from disease is 10 times than from vaccination, study finds", https://www.bmj.com/content/373/bmj.n1005.full; Wise et al, "COVID-19: Should we be worried about reports of myocarditis and pericarditis after mRNA vaccines?", https://www.bmj.com/content/373/bmj.n1635.

37. Since April 2021, there have been rare reports of heart inflammation, known as myocarditis (inflammation of the heart muscle) or pericarditis (inflammation of the

outer lining of the heart), in individuals who have received the COVID-19 mRNA (Pfizer BioNTech, Moderna) vaccines. Cases have tended to occur in males over 16 or young adults within a few days of the second dose of mRNA vaccine. Most affected people have responded well to treatment and rest. CDC continues to recommend vaccination of children age 12 and older, given the risks of infection with the virus that causes COVID-19 and related, possibly severe complications that may ensue. *See* Myocarditis and Pericarditis following mRNA COVID-19 vaccination, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/myocarditis.html)

38. The American Association of Pediatrics continues to recommend COVID-19 vaccination as the benefits are felt to outweigh the risk of myocarditis or pericarditis. *See* https://pediatrics.aappublications.org/content/148/2/e2021052336

39. The rate of myocarditis in all recipients is reported as 13 cases per million (0.0013%) doses of mRNA vaccines delivered (32 cases per million – 0.0032% -- in males age 12-39). *See* Myocarditis with COVID-19 mRNA vaccines, https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.121.056135. All vaccine-associated cases of myocarditis were treated and those with follow up were found to improve and survive. In contrast, 2.3% of COVID-19 recovered college athletes had imaging evidence of myocarditis. *See* Daniels et al, Prevalence of Clinical and Case 3:21-cv-00924-JAM Document 27-2 Filed 08/11/21 Page 12 of 27 Subclinical Myocarditis in Competitive Athletes with Recent Sars-CoV-2 Infection: Results from the Big Ten Covid-19 Cardiac Registry, https://jamanetwork.com/journals/jamacardiology/fullarticle/2780548. In a risk-benefit analysis, the decision of the Advisory Committee on Immunization Practices (who makes recommendations to the CDC) remains in favor of vaccination to prevent not only COVID-19 related hospitalizations and death, but also COVID-19 related complications (myocarditis, MIS-C, and 'long COVID-19'). *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7032e4.htm The CDC continues to recommend COVID-19 mRNA vaccination in individuals ages 12 and older. *See* Selected Adverse Events After COVID-19 Vaccination, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/adverse-events.html.

40. There have been extremely rare reports of very serious blood clots (in particular, cerebral venous sinus thrombosis or CVST) associated with low platelet counts following the Johnson and Johnson COVID-19 vaccine (0.2-2.3 cases per million doses). This side effect was also seen with the adenovirus-vectored AstraZeneca COVID-19 vaccine which is licensed for use in the UK and EU (2.7 – 4.8 cases per million doses). This type of stroke occurs, on rare occasions, in individuals with certain risk factors (genetic clotting disorders, pregnancy, birth control pills, malignancy or certain infections). Individuals who are ill with COVID-19 have a much higher risk of blood clots in general. The specific risk for CVST in COVID-19 patients is estimated at 207 per million cases. *See* ACIP-Reports of cerebral venous sinus thrombosis with thrombocytopenia after Janssen COVID-19 vaccine-April 14, 2021 (cdc.gov); Cerebral Venous Sinus Thrombosis in the U.S. Population, After Adenovirus-Based SARS-CoV-2 Vaccination, and After COVID, Journal of the

American College of Cardiology, vol 78 (4): 408-411.

Vaccine Adverse Event Reporting System.

41. The Vaccine Adverse Event Reporting System (VAERS) is a passive reporting system for any vaccine administered in the United States. With regard to COVID-19 vaccine, CDC requires that vaccine providers report administration errors, serious adverse events, causes of multisystem inflammatory syndrome and any cases of COVID-19 that result in hospitalization or death after administration of COVID-19 while still under EUA. Anyone can report a symptom to VAERS, including patients and family members of patients. A symptom report to VAERS does not imply causation, only that a symptom or outcome occurred after vaccination, according to the reporting party. However, monitoring of VAERS can help to identify safety concerns that might not other be captured. *See* https://www.fda.gov/vaccines-blood-biologics/vaccine-adverse-events/vaccine-adverse-event-reporting-system-vaers-questions-and-answers.

42. Monitoring of the VAERS system has revealed several extremely rare serious adverse events, including Guillaine-Barre and thrombosis with thrombocytopenia syndrome (TTS) following the Johnson and Johnson vaccine and myocarditis following COVID-19 mRNA vaccine (Pfizer BioNtech and Moderna). A meeting of the Advisory Committee of Immunzation Practices (ACIP) on July 22, 2021 to review these serious adverse events concluded that the benefits outweigh the risks of COVID-19 vaccination. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7032e4.htm

Vaccination After COVID-19 Infection.

43. Re-infection after natural COVID-19 infection can occur due to waning antibody responses. The CDC therefore continues to recommend COVID-19 vaccination in individuals following natural infection. *See* Frequently Asked Questions about COVID-19 Vaccination, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/faq.html; Interim Clinical Considerations for Use of COVID-19 Vaccines | CDC), https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html

44. The risk of re-infection is markedly reduced if the naturally infected individual subsequently receives a COVID-19 vaccine. *See* Reduced Risk of Reinfection with SARS-CoV-2 After COVID-19 Vaccination — Kentucky, May–June 2021 | MMWR, https://www.cdc.gov/mmwr/volumes/70/wr/mm7032e1.htm. Recent studies have shown an expanded breadth of the antibody response in individuals who have had natural infection followed by COVID-19 vaccine. *See* Naturally enhanced neutralizing breadth against SARS-CoV-2 one year after infection, https://www.nature.com/articles/s41586-021-03696-9.

45. There are no reports of serious, life-threatening adverse events in individuals recovered from COVID-19 who subsequently received COVID-19 vaccine. Therefore, CDC continues to recommend COVID-19 vaccine in those who have previously had COVID-19. *See* Interim Clinical Considerations for Use of COVID-

19 Vaccines | CDC, https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html).

Current COVID-19 Risks.

46. There has been a steady increase in the number of cases of and hospitalizations due to COVID-19 in Massachusetts since June 2021. *See* https://www.mass.gov/info-details/covid-19-response-reporting#covid-19-interactive-data-dashboard-.

47. New variants of COVID-19 continue to evolve and disseminate throughout the world. Variants are a concern as they may lead to viruses that: (a) have an increased ability to spread; (b) are able to escape detection by diagnostic assays; (c) are potentially less susceptible to existing vaccines; and (d) may lead to more severe disease outcomes.

48. CDC is actively monitoring trends of SARS-CoV-2 variants. *See* SARS-CoV-2 Variant Classifications and Definitions, https://www.cdc.gov/coronavirus/2019-ncov/variants/variant-info.html)

49. A recent COVID-19 outbreak in Provincetown, MA resulted in over 900 new COVID-19 infections. *See* https://www.barnstablecountyhealth.org/newsroom/july-30-2021-update-covid-19-cluster-in-provincetown. Of 560 cases in MA residents, 73% were vaccinated. Seven individuals were hospitalized with zero deaths. Risk factors for this cluster included large crowds (the population of Provincetown increases from approximately 3,000 to approximately 60,000 when tourists arrive), large capacity indoor parties, and no masking.

50. Ninety percent of 133 viruses that were sequenced during the Provincetown cluster were identified as Delta variant, which is known to be highly transmissible. The cycle threshold value, an indirect measure of the amount of virus in a sample, was the same in vaccinated and unvaccinated individuals. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7031e2.htm. These data, taken together, further reinforce the knowledge about the increased transmissibility of the Delta variant, not only for unvaccinated, but also vaccinated individuals.

51. Vaccine efficacy could not be assessed as this would require knowing the vaccination status of all individuals in Provincetown during this cluster.

52. While some have stated that this was a 'vaccine failure,' it is actually a vaccine success, as there was reduced disease severity and no deaths, which are the most important outcomes of COVID-19 vaccination. In contrast, a cluster investigation of a wedding reception in rural Maine with 55 unvaccinated unmasked individuals in August – September 2020 led to 177 epidemiologically linked infections, including 7 hospitalizations and 7 deaths. *See* https://www.cdc.gov/mmwr/volumes/69/wr/mm6945a5.htm.

53. COVID-19 vaccines are extremely effective at preventing hospitalization and death,

even in older individuals. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7032e3.htm.

54. From January 1 – April 30, 2021, a total of 10,262 infections in fully immunized individuals were reported to CDC. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7021e3.htm. Beginning on May 1, 2021, CDC began to collect information on post-vaccination COVID-19 infections that led to hospitalization or deaths related to COVID-19 infection.

55. As of August 15, 2021, more than 168 million people had been fully vaccinated in the US. *See* https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total. During that same time period, reports from 49 states and US territories indicated that a total of 8,054 fully vaccinated individuals had been hospitalized or died as a result of COVID-19 infection. *See* https://www.cdc.gov/vaccines/covid-19/health-departments/breakthrough-cases.html. In an article in the New York Times, data from 44 of the 50 state departments of health showed that only 0.1 – 4% of hospitalizations occurred in individuals who have been fully vaccinated against COVID-19 ('breakthrough infections'). *See* https://www.nytimes.com/interactive/2021/08/10/us/covid-breakthrough-infections-vaccines.html. Some states still do not track this information, and others provided incomplete data sets.

Herd Immunity.

56. COVID-19 rates are increasing among Massachusetts residents with transmission rates in all counties considered to be substantial or high. *See* https://covid.cdc.gov/covid-data-tracker/#county-view.

57. Massachusetts has not yet reached herd immunity.

58. Herd immunity is the indirect protection afforded to those who are not immune to a disease that occurs when most of a population is immune to an infectious disease. The percent of the population required to be immune differs by pathogen, and for COVID-19 is currently unknown.

59. Many effective vaccines prevent illness but do not entirely eliminate the pathogen. COVID-19 vaccines are highly effective at preventing COVID-19, including serious outcomes of severe disease such as hospitalizations and death. *See* https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/fully-vaccinated-people.html.

60. The level of protection required for herd immunity for COVID-19 is not presently known. Some believe that due to the evolution of SARS-CoV-2 variants, that herd protection will not be achieved. *See* Kadkhoda, Herd Immunity to COVID19: Alluring and Elusive, https://academic.oup.com/ajcp/article/155/4/471/6063411?login=true; Taylor, COVID-19: Is Manaus the final nail in the coffin for natural herd immunity?

https://www.bmj.com/content/372/bmj.n394.short; Tkachenko et al, Time-Dependent Heterogeneity leads to transient suppression of the COVID-19 epidemic, not herd immunity, https://www.pnas.org/content/118/17/e2015972118.short; Burki, Herd Immunity for COVID-19, Herd immunity for COVID-19 - The Lancet Respiratory Medicine

61. The current CDC Director has stated that the target for herd immunity is not known but that increasing the level of immunization is important for community protection. *See* https://www.foxnews.com/health/no-magic-target-herd-immunity-walensky. The variables that would need to be included in calculations of herd immunity for COVID-19 are uncertain making any such thresholds highly inaccurate. *See* Five reasons why COVID herd immunity is probably impossible (nature.com)

Asymptomatic and pre-Symptomatic Spread of COVID-19

62. Early in the pandemic, it was recognized that asymptomatic or pre-symptomatic infection is a major driver of spread of the SARS-CoV-2 virus. Up to 30% of infected individuals never develop symptoms and spread from such asymptomatic individuals has been estimated to account for more than half of all transmissions. *See* https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2774707; https://academic.oup.com/cid/article/71/10/2679/5851471. Individuals infected with COVID-19 have been found to be highly infectious during the pre-symptomatic period (48 hours prior to start of symptoms) and are a major contributor to viral spread. *See* https://wwwnc.cdc.gov/eid/article/27/4/20-4576_article https://www.nejm.org/doi/full/10.1056/nejmoa2008457

63. Since symptoms do not predict infectivity, to prevent transmission from asymptomatic or pre-symptomatic individuals, quarantine for the duration of the potential infectious window has been the tool used to prevent SARS-CoV-2 transmission in exposed individuals.

64. Masking is an effective tool to prevent the spread of the virus that causes COVID-19. The level of protection from masks is significantly less than that afforded by vaccination, but is an important tool to implement for those who are unable to be vaccinated or for individuals in whom vaccination is anticipated to be largely ineffective. Unvaccinated individuals who do not wear masks put themselves at risk as well as others around them who are at increased risk of SARS-CoV-2 or who are immunocompromised. *See* https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/masking-science-sars-cov2.html

College-Aged Individuals and COVID-19.

65. While the mortality rate from COVID-19 in those 18-29 years of age is lower than that in older age groups, on a per capita basis this age group has had the highest rates of infection since July 2020. While the percent likelihood of hospitalization and deaths have been lower in this age group, the rising numbers of infections in this age group have led

to increasing numbers of hospitalizations of young people, especially in areas of the US with low vaccination rates. *See* https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions

66. As a new virus, the long-term effects of natural infection with SARS-CoV-2 are unknown. So-called "long COVID," which can lead to long-term disability, can affect young adults regardless of disease severity. *See* https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects.html. A study of long-term complications in mild-to-moderately severe COVID-19 patients who were not hospitalized showed that 50% of patients aged 16 - 30 had lingering symptoms at 6 months, including concentration/memory difficulties, shortness of breath, and fatigue. *See* https://www.nature.com/articles/s41591-021-01433-3. Such symptoms may affect the ability of students to learn and progress academically. Heart inflammation is particularly a concern in young athletes who return to sports after asymptomatic infection or mild illness. *See* https://jamanetwork.com/journals/jamacardiology/fullarticle/2780548.

67. The goal of universal vaccination to protect the individual is vital, but reduction of exposures and transmissions to protect the campus community and the communities-at-large are equally important.

68. The college setting is comprised not only of students, but also includes faculty and staff with an older age demographic. Increasing age and pre-existing medical conditions increase the risk for severe disease in COVID-19. *See* https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

69. Infections in college-age individuals are potential drivers of infections in the community. *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7001a4.htm; https://www.medrxiv.org/content/10.1101/2020.09.22.20196048v1. A modeling study showed that colleges pose the risk of super-spreader events in neighboring communities, especially in the first two weeks after students return to campus. *See* https://www.tandfonline.com/doi/full/10.1080/10255842.2020.1869221. COVID-19-infected college-age individuals, who may be asymptomatic, pre-symptomatic or mildly symptomatic, may spread the virus that causes COVID-19 to other at-risk students, faculty or staff or to members of the community who may be immunocompromised, elderly, or not vaccine eligible.

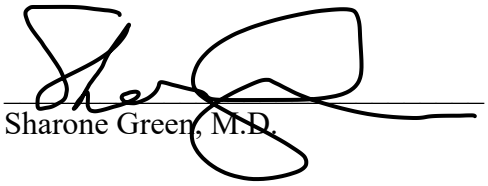
70. There have been significant differences in the level of COVID-19 transmissions on college campuses which have impacted the ability of these local epidemics to spread into neighboring communities. Robust infection prevention strategies on college campuses such as masking and surveillance testing have been useful, but have not prevented outbreaks due to lack of adherence. Universal immunity to SARS-CoV-2 by way of immunization is the best and safest way to prevent COVID-19.

Conclusion

71. In my expert opinion, the University of Massachusetts' requirement that its students be vaccinated against COVID-19 is a safe, effective, and reasonable measure to protect the public health by lessening and/or preventing on-campus and community transmission among students, employees, and their communities and will significantly lessen morbidity and mortality in those populations. Individuals with immune compromise constitute ~2.7% of the US population and are likely similarly represented on the UMass campuses. This population is known to generate a lower immune response to COVID-19 vaccines and thus may remain susceptible after vaccination. While the most severely immune compromised have been recently approved to receive booster immunizations (https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/immuno.html), a large proportion of these individuals will remain vulnerable due to their underlying conditions. Beyond severe immunocompromise, there are many students, faculty, and staff who have medical conditions which put them at risk for severe COVID-19 (e.g. obesity, cardiovascular disease, renal disease, diabetes) and who may not generate as robust an immune response to vaccine. Immunization of students, faculty, and staff will help not only the individual, but also the community by protecting those who are vulnerable and affording them the same opportunity to participate in all learning and research opportunities on campus.

72. I hold all of the above opinions to a reasonable degree of professional certainty and probability based upon the records and information that I reviewed and based upon my education, training, and professional experience. My opinions in this report are based on only the information that I have considered to date. I reserve the right to amend and supplement this report and any of my opinions in it consistent with all applicable procedural rules.

Date: August 17, 2021



Sharone Green, M.D.